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# Flood Management Report

77 Central Road, Avalon Beach

## Issue A

Prepared for: Joel Schuberg

Prepared by: Hannah Stubleby



# Flood Management Report

**Project no:** 2409049

**Issue:** A

**Date:** 10.12.2024

**Client:** Joel Schuberg

**Engineer:** Hannah Stubley

**Principal review:** Michael Wachjo

**Council:** Northern Beaches Council (Region 1)

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Issue	Engineer	Peer Review	Principal Review	Description	Date
A	H.Stubley	S.Raaff	M.Wachjo	Report for DA submission	10.12.2024

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## 1. Introduction

At the request of Mathieson Architects, Northern Beaches Consulting Engineers have assessed the flooding regime at 77 Central Road, Avalon Beach to determine the effect of the proposed development on the existing floodplain.

For the undertaking of this report, Northern Beaches Consulting Engineers (NBCE) has analysed the general drainage patterns of the catchment and has considered the effects of overland flow flooding as determined in the Council Supplied Flood information with respect to the proposed development. This report has been prepared in accordance with:

- *Australian Rainfall and Runoff Guidelines 2019*
- *Northern Beaches Council (Pittwater Area)*
- *Pittwater Local Environmental Plan 2013 (LEP)*
- *Pittwater Development Control Plan (DCP) – Section B3.11 Flood Prone Land*
- *NSW Government Floodplain Management Manual (2005)*
- *Council supplied flood information*

### 1.1 Aim

This study explores the impact of overland flow flooding envisaged to occur at the subject site up to the 1% AEP storm event. The development under consideration is located at 77 Central Road, Avalon Beach. This area is predicted to experience Mainstream flooding during heavy rainfall events. The anticipated flood behaviour within the contributing catchment for the 1% Annual Exceedance Probability (AEP) and Probable Maximum Flood (PMF) has been assessed in relation to the proposed development at the subject site.

### 1.2 Description of Development

The proposed development at the residential property at 77 Central Road, Avalon Beach consists of a new dwelling, pool and landscaping (refer Appendix C).

### 1.3 Site Conditions

The property is approximately 1306m<sup>2</sup> and located within the Northern Beaches Council (Pittwater Area) LGA. The subject site is mildly sloping to the south. A council owned creek runs in a easterly trajectory within Toongari Reserve located directly behind the southern boundary of the property.



*Figure 1: Site locality*

### 1.4 Flood Behaviour

The development lies within the Careel Creek Catchment. Flooding within the area occurs when intense local rainfall generates runoff exceeding the capacity of council's drainage infrastructure causing the creek banks to overtop.

## 2. Flood Analysis

### 2.1 Site Flooding Extent

The site flooding extent has been determined using Council's available flood information. All relevant flood information is shown below (Refer Appendix A):

Flood Planning Level (FPL) (Max):	12.86 m AHD
Predicted 1% AEP flood level (Max):	12.36 m AHD
Predicted 1% AEP flood depth (Max):	0.57 m
1% AEP Maximum Velocity (Max):	0.89 m/s
Probable Maximum Flood (PMF) level:	12.76 m AHD
Probable Maximum Flood (PMF) Depth:	0.88 m
Probable Maximum Flood (PMF) velocity:	1.52 m/s
Flood Hydraulic Category:	Flood Fringe – Floodway
Flood Risk Precinct:	Low – High Risk
Flood Life Hazard Category:	H1-H5
Mapping of relevant extents:	Refer Appendix B
Proposed Ground Floor Level (FFL) Level:	12.91m AHD (refer Appendix C)
Proposed First Floor Level (FFL) Level:	16.63m AHD (refer Appendix C)

## 3. Assessment of Impacts

### 3.1 Development Matrix

The subject site is classified under the residential category in figure 2 below.

High Flood Risk Precinct						
		Vulnerable & Critical Use	Residential Use	Business & Industrial Use	Recreational & Environmental Use	Subdivision & Civil Works
A	Flood effects caused by Development	A1 A2	A1 A2	A1 A2	A1 A2	A1 A2
B	Building Components & Structural	B1 B2 B3	B1 B2 B3	B1 B2 B3	B1 B2 B3	
C	Floor Levels	C2 C3	C1 C3 C4 C6	C1 C3 C4 C6 C7	C3	C5
D	Car Parking	D1 D2 D3 D4 D7	D1 D2 D3 D4 D5 D6	D1 D2 D3 D4 D5 D6	D1 D2 D3 D4 D5 D6	D1
E	Emergency Response	E1 E2	E1	E1	E1	E3
F	Fencing	F1	F1	F1	F1	F1
G	Storage of Goods	G1	G1	G1	G1	
H	Pools	H1	H1	H1	H1	H1

Figure 2 - Development Matrix. Source: Northern Beaches Council Website Information

Table 1 - Assessment of Impacts Table

		Compliance	
	Not Applicable	Yes	No
A Flood effects caused by the development		X*	
B Building Components & Structural		X*	
C Floor Levels		X*	
D Carparking		X*	
E Flood Emergency Response		X*	
F Fencing		X*	
G Storage of Goods		X*	
H Pools		X*	

\*Note – Compliance achievable should the recommendations outline in this report be adopted

## 4. Assessment and Recommendations

### 4.1 Flood effects caused by Development

**A1: Development shall not be approved unless it can be demonstrated in a Flood Management Report that it has been designed and can be constructed so that in all events up to the 1% AEP event:**

- (a) There are no adverse impacts on flood levels or velocities caused by alterations to the flood conveyance; and*
- (b) There are no adverse impacts on surrounding properties; and*
- (c) It is sited to minimise exposure to flood hazard.*

**Major developments and developments likely to have a significant impact on the PMF flood regime will need to demonstrate that there are no adverse impacts in the Probable Maximum Flood.**

**Development Compliance:** Only minor works are proposed within the extent of the 1% AEP flood which consists of a new pool, fencing and wall. The pool is to be located at RL 12.130m AHD which is partially flush with natural ground level (NGL). The NGL gradually slopes away from north to south, meaning the pool coping gradually rises above NGL as it extends towards the southern end. At the southern end of the pool, the coping will be approximately 150mm above NGL. The pool is largely located within the flood fringe and as such is not expected to cause adverse impacts on the flood conveyance and surrounding properties. Where it extends into flood storage, compensatory works have been proposed (Refer section 4.1-A2 and 4.8 for further detail).

The proposed pool wall and pool fencing that is located within the 1% AEP flood extent is to be a minimum 50% open up to the 1% AEP flood level (RL 12.36m AHD). Therefore, the proposed development is not anticipated to have an adverse impact on the conveyance of flood waters across the site or surrounding properties.

The proposed main dwelling is generally located outside the extent of the 1% AEP and PMF. Therefore, the development is sited so as to minimise exposure to flood hazard.

**A2: Development shall not be approved unless it can be demonstrated in a Flood Management Report that in all events up to the 1% AEP event there is no net loss of flood storage.**

**Consideration may be given for exempting the volume of standard piers from flood storage calculations.**

**If Compensatory Works are proposed to balance the loss of flood storage from the development, the Flood Management Report shall include detailed calculations to demonstrate how this is achieved.**

**Development Compliance:** The proposed development works are largely located within the flood fringe. A small portion of the south-western corner of the pool is located within the flood storage extent resulting in a minor flood blockage. Lowering the pool to the lowest natural ground level of approximately RL 11.97m AHD, would result in a blockage along the downstream side of the pool. Therefore, to compensate, the pool blockage will be offset by lowering approximately 10m<sup>2</sup> of the lawn by 20mm to ensure no net loss of flood storage and to maintain the existing natural flow path (Refer Appendix B for flood storage calculations). The excavated area is to be free draining with a minimum 1% fall to ensure no trap points are created.



## 4.2 Building Components and Structural Soundness

**B1:** All buildings shall be designed and constructed with flood compatible materials in accordance with “Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas”, Hawkesbury-Nepean Floodplain Management Steering Committee (2006).

**Development Compliance:** All buildings located within the 1% AEP flood extent are to be designed and constructed with flood compatible materials in accordance with “Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas”, Hawkesbury-Nepean Floodplain Management Steering Committee (2006). Below are key areas to be considered in the architectural and structural design of the development:

Structural element	Recommendations
<b>Ground Floor</b>	
Raised concrete slab	<ul style="list-style-type: none"> <li>In areas of high silt deposition, use a deeper slab rebate to hold more slit without it bridging the wall cavity.</li> </ul>
Slab on ground	<ul style="list-style-type: none"> <li>In areas of high slit deposition, use a deeper slab rebate to hold more slit without it bridging the wall cavity.</li> </ul>
Suspended timber floor	<ul style="list-style-type: none"> <li>Ventilation needed to ensure drying and to prevent decay of timber components.</li> <li>Allow for some loss of load bearing capacity with manufactured/engineered timber beams.</li> <li>Select plywood flooring with waterproof glue bond.</li> <li>Avoid particleboard flooring (which weakens after immersion) and underfloor thermal and noise insulation or remove it post-flood to assist drying.</li> <li>To reduce the risk of ponding in subfloor areas after flooding has occurred, the sub-floor area is to be filled and levelled to ensure that it is highest at the centre and drains to the edges.</li> <li>Provide a minimum 450mm clearance required between underside of timber structure and ground as per BCA.</li> <li>Timber used in sub-floor structural members and in flooring should be minimum H3 (Avoid using LVL's)</li> </ul>
<b>Load Bearing Wall System</b>	
Concrete walls (including concrete panels, blockwork and poured in-situ concrete)	<ul style="list-style-type: none"> <li>Concrete walls can be designed to resist additional wall loads by use of suitable reinforcement.</li> <li>Unfinished concrete blockwork may need to be painted if any waterproofing is required in a wall.</li> </ul>
Cavity Brick (double brick)	<ul style="list-style-type: none"> <li>Provide for ingress of water to balance hydrostatic forces inside and outside of the walls.</li> <li>Include openings into cavity to facilitate removal of slit from cavity.</li> </ul>
Timber wall frame	<ul style="list-style-type: none"> <li>Provide for ingress of water to balance hydrostatic forces inside and outside of the walls.</li> <li>Include openings into cavity to facilitate removal of slit from cavity.</li> <li>With load bearing members such as stud wall frame; lintels; spanning beams: <ul style="list-style-type: none"> <li>Avoid materials/glue bonds which can weaken significantly with immersion, &amp;</li> <li>Prevent deterioration from moisture over time by providing adequate drainage and ventilation.</li> </ul> </li> <li>Bracing is critical to resist forces from wind gusts and flowing water.</li> </ul>

Non Load Carrying Components Exterior Wall Cladding	
Brick Veneer cladding with stud frame	<ul style="list-style-type: none"> <li>• Improve brick wall stability through use of inside fixed ties.</li> <li>• Use articulation joints to limit cracking from uneven foundation movement.</li> <li>• Provide generous venting through brickwork to balance hydrostatic forces and maximise cavity drying rate to minimise timber decay.</li> <li>• Protect frame from failure and bottom sliding. For locations where there may be a high frequency of flooding use stainless steel or other high durability ties with angled surfaces to promote runoff.</li> </ul>
Sheet or plank weatherboard cladding on stud frame e.g. fibre cement, plywood	<ul style="list-style-type: none"> <li>• Use materials not impaired by immersion e.g. fibre cement or waterproof plywood sheets.</li> </ul>
Non Load Carrying Components Interior Lining of Walls	
Bare Face Bricks or Cement Render	<ul style="list-style-type: none"> <li>• Staining of light-coloured face bricks may be a consideration.</li> </ul>
Plywood with Stud Frame	<ul style="list-style-type: none"> <li>• Grades with waterproof bond recover strength after drying out.</li> <li>• Horizontal sheet fixing can reduce replacement costs.</li> <li>• With a timber frame, the cavity should be well ventilated to reduce the chance of timber decay.</li> <li>• Leave lower edge lining 30mm above bottom wall plate or cut notches to allow entry of water, ventilation, and silt removal. Use deeper skirting boards to cover openings on lining. Screw fixings enables easy removal.</li> </ul>
Plasterboard with Stud Frame	<ul style="list-style-type: none"> <li>• As sheets are weakened and can incur permanent damage and loss of strength, ignore wall bracing contribution from lining.</li> <li>• Horizontal sheet fixing can reduce replacement costs.</li> <li>• With a timber frame, the cavity should be well ventilated to reduce chance of timber decay.</li> <li>• Leave at least 30mm above bottom wall plate or cut notches to allow entry of water, ventilation, and silt removal. Use deeper skirting boards to cover openings on lining. Screw fixings enables easy removal.</li> </ul>
Non load carrying component	
Plasterboard	<ul style="list-style-type: none"> <li>• Insert small air vents in the ceiling to relieve pressure from trapped air in the room and ventilate enclosed areas to reduce risk of timber decay.</li> </ul>
Non-structural components (Joinery, built-in furniture):	<ul style="list-style-type: none"> <li>• Avoid false floors in cupboards and wardrobes</li> <li>• Build units on legs to allow for cleaning and free flowing air underneath</li> <li>• Provide holes for drainage and ventilation to closed-off areas and hollow components</li> <li>• Construct joints so they shed water</li> <li>• Use supports at closer centres with structural ply panelling to limit permanent distortion (position supports at less than 500mm centres).</li> <li>• Refer section 6 of Reducing Vulnerability of Buildings to Flood Damage for further details of non-structural component design.</li> </ul>

Any new structures are to be constructed of fit for purpose building materials in accordance with “Reducing vulnerability of buildings to flood damage”. It is not recommended to use timber framed construction for any new structures below the FPL (12.86m AHD) or any construction which result in voids that are difficult to clean out after a flooding event. However, if timber framed construction is to be used, then the builder is to ensure that new structures are to be constructed in accordance with the above table.

***B2: All new development must be designed and constructed to ensure structural integrity up to the Flood Planning Level, taking into account the forces of floodwater, wave action, flowing water with debris, buoyancy and immersion. Where shelter-in-place refuge is required, the structural integrity for the refuge is to be up to the Probable Maximum Flood level. Structural certification shall be provided confirming the above.***

**Development Compliance:** All new structures are to be designed and constructed to ensure structural integrity up to the FPL (12.86m AHD), taking into account the forces of floodwater, wave action, flowing water with debris and buoyancy and immersion. The required on-site refuge (refer section 4.5) is proposed to be located in the new living room on the ground floor (FFL 12.91m AHD). The on-site refuge is to be designed and constructed to ensure structural integrity up to the PMF (12.76m AHD), taking into account the forces of floodwater, wave action, flowing water with debris and buoyancy and immersion. This will require the shelter in place to be structurally isolated such that it is designed as an independent structure to prevent it being dragged with the surrounding structure. Any beams supporting the structure around are not to run through the shelter in place.

***B3: All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections must be waterproofed and/or located above the Flood Planning Level. All existing electrical equipment and power points located below the Flood Planning Level within the subject structure must have residual current devices installed that turn off all electricity supply to the property when flood waters are detected.***

**Development Compliance:** The switchboard and main circuit unit must be fitted above the FPL (12.86m AHD). All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections must be waterproofed and/or located above the FPL (12.86m AHD) and conduits must be laid such that they are free draining. All existing electrical equipment and power points located below the FPL (12.86m AHD) within the subject structure must have residual current devices installed that turn off all supply of electricity to the property when flood waters are detected.

### 4.3 Floor Levels

***C1: New floor levels within the development shall be at or above the Flood Planning Level.***

**Development Compliance:** The ground floor levels (FFL 12.91m AHD and FFL 14.5m AHD) and proposed first floor levels (FFL 16.63m AHD and FFL 17.20m AHD) are located above the FPL (RL 12.86m AHD).

The proposed utility room is to be located below the FPL at FFL 11.73m AHD. The utility room is to be fully tanked and entry to the utility room is to be internal only.

**C3:** All new development must be designed and constructed so as not to impede the floodway or flood conveyance on the site, as well as ensuring no net loss of flood storage in all events up to the 1% AEP event.

*For suspended pier/pile footings:*

*(a) The underfloor area of the dwelling below the 1% AEP flood level is to be designed and constructed to allow clear passage of floodwaters, taking into account the potential for small openings to block; and*

*(b) At least 50% of the perimeter of the underfloor area is of an open design from the natural ground level up to the 1% AEP flood level; and*

*(c) No solid areas of the perimeter of the underfloor area would be permitted in a floodway*

**Development Compliance:** The main development is not located within the 1% AEP flood extent and as such is not expected to impede the flood conveyance. Minor works consisting of the pool and associated fencing and wall are to be located within the 1% AEP flood extent. The pool coping is to be flush with natural ground level and suspended where this is not achievable (Refer section 4.1 and 4.8) The pool fencing and wall within the 1% AEP extent is to be of an open design (Refer section 4.6).

## 4.4 Car Parking

**D5:** Enclosed Garages must be located at or above the 1% AEP level

**Development Compliance:** The proposed enclosed garage (FFL 14.5m AHD) is located above the FPL (12.86m AHD) and is not located within the 1% AEP flood extent.

## 4.5 Emergency Response

**E1:** If the property is affected by a Flood Life Hazard Category of H3 or higher, then Control E1 applies and a Flood Emergency Assessment must be included in the Flood Management Report.

Where flood-free evacuation above the Probable Maximum Flood level is not possible, new development must provide a shelter-in-place refuge where:

*a) The floor level is at or above the Probable Maximum Flood level; and*

*b) The floor space provides at least 2m<sup>2</sup> per person where the flood duration is long (6 or more hours) in the Probable Maximum Flood event, or 1m<sup>2</sup> per person for less than 6 hours;*

*c) It is intrinsically accessible to all people on the site, plainly evident, and self-directing, with sufficient capacity of access routes for all occupants without reliance on an elevator; and) It must contain as a minimum: sufficient clean water for all occupants; portable radio with spare batteries; torch with spare batteries; and a first aid kit*

**Development Compliance:** The property is affected by a Flood Life Hazard Category of H5. Flood free evacuation above the PMF (12.76m AHD) is not possible, therefore a shelter-in place refuge is recommended. The living room (FFL 12.91m AHD) is proposed to provide an on-site refuge above the PMF (12.76m AHD). The on-site refuge must have appropriate access installed to enable access points from all areas within the development and is to be designed and constructed in accordance with Section 4.4 of this report to ensure structural integrity up to the PMF (12.76m AHD). Refer to Figure 3 below for the on-site refuge plan.

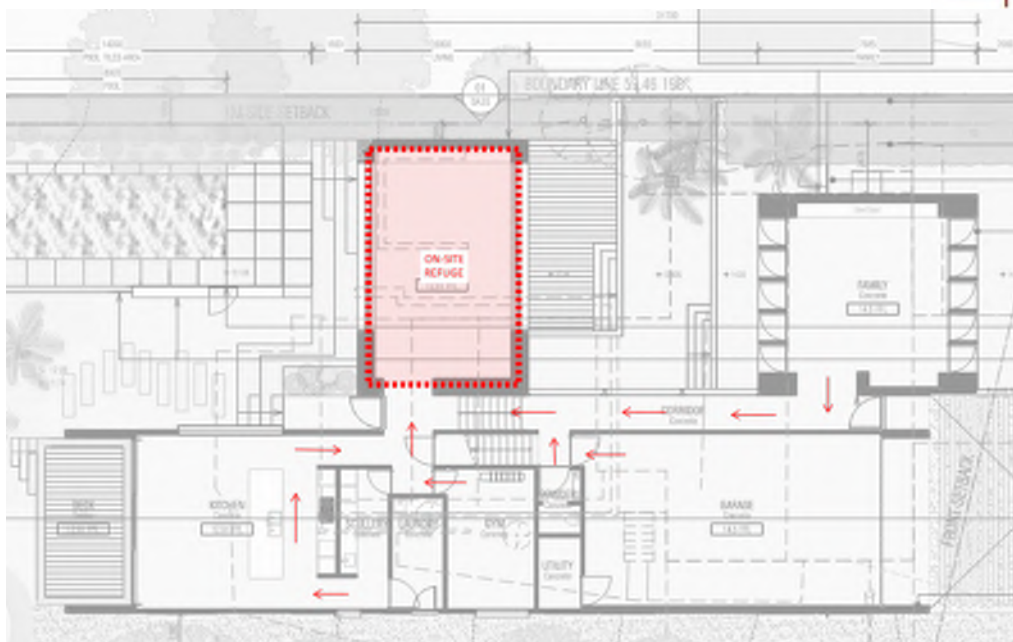


Figure 3: On-site refuge plan

The on-site refuge must provide:

- Sufficient clean water for all occupants
- Portable radio with spare batteries
- Torch with spare batteries
- First aid Kit

If flooding is experienced:

- Evacuate to the designated on-site refuge location.
- Evacuate if ordered by Emergency Services Personnel regardless of availability of on-site refuge.

### Important Contact Information

NSW SES: 132 500

Life-threatening Emergencies: 000

Northern Beaches Council: 1300 434 434

## 4.6 Fencing

**F1: Fencing, (including pool fencing, boundary fencing, balcony balustrades and accessway balustrades) shall be designed so as not to impede the flow of flood waters and not to increase flood affectation on surrounding land. At least 50% of the fence must be of an open design from the natural ground level up to the 1% AEP flood level. Less than 50% of the perimeter fence would be permitted to be solid. Openings should be a minimum of 75 mm x 75mm.**

**Development Compliance:** All fencing is to be constructed of an open design to allow the 1% AEP floodwater to flow through the property unimpeded. The fencing must be a minimum of 50% open from natural ground level up to the 1% AEP flood level, with openings a minimum of 75mm x 75mm.

## 4.7 Storage of Goods

**G1: Hazardous or potentially polluting materials shall not be stored below the Flood Planning Level unless adequately protected from floodwaters in accordance with industry standards.**

**Development Compliance:** All hazardous or potentially polluting materials are to be stored above the FPL of 12.86m AHD.

## 4.8 Pools

**H1: Pools located within the 1% AEP flood extent are to be in-ground, with coping flush with natural ground level. Where it is not possible to have pool coping flush with natural ground level, it must be demonstrated that the development will result in no net loss of flood storage and no impact on flood conveyance on or from the site.**

**All electrical equipment associated with the pool (including pool pumps) is to be waterproofed and/or located at or above the Flood Planning Level.**

**All chemicals associated with the pool are to be stored at or above the Flood Planning Level.**

**Development Compliance:** The pool is proposed to be located at RL 12.130m AHD which is partially flush with natural ground level (NGL). The NGL gradually slopes away from north to south, meaning the pool coping gradually rises above NGL as it extends towards the southern end. At the southern end of the pool, the coping will be approximately 150mm above NGL. The pool is largely located within the flood fringe and as such is not expected to cause adverse impacts on the flood conveyance and surrounding properties. Where it extends into flood storage, compensatory works have been proposed and as such will result in no net loss of flood storage (Refer section 4.1-A2 for further detail).

All new electrical and chemical equipment associated with the pool must be waterproofed and/or located above the Flood Planning Level of 12.86m AHD.

## 5. Conclusion

In accordance with accepted engineering practice, NBCE have undertaken a flood study at the above-mentioned site. No anticipated increased flooding is envisaged to occur at the subject site due to the proposed development should the recommendations of this report be carried out. The flood information provided by Northern Beaches Council has been used for this assessment. The recommendations of this report should be adopted for the development to meet the requirements of *Northern Beaches Council Development Control Plan (DCP)*. Please contact the author if further clarification is required.

### NORTHERN BEACHES CONSULTING ENGINEERS P/L

Author:



**Hannah Stuble**

Engineer 3

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Reviewed By:



**Michael Wachjo**

Director | B.E.(Civil), MIEAust.

## APPENDIX A

### Council Flood Information

# BASIC FLOOD INFORMATION REPORT

**Property:** 77 Central Road AVALON BEACH NSW 2107

**Lot DP:** Lot 19 DP 8698

**Issue Date:** 20/09/2024

**Flood Study Reference:** Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory

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## Flood Information<sup>1</sup>:

### **Map A - Flood Risk Precincts**

Maximum Flood Planning Level (FPL) <sup>2, 3, 4</sup>: 12.86 m AHD

### **Map B - 1% AEP Flood**

1% AEP Maximum Water Level <sup>2, 3</sup>: 12.36 m AHD

1% AEP Maximum Depth from natural ground level<sup>3</sup>: 0.57 m

1% AEP Maximum Velocity: 0.89 m/s

### **Map C - 1% AEP Hydraulic Categorisation**

1% AEP Hydraulic Categorisation: Floodway / Flood Fringe

### **Map D - Probable Maximum Flood (PMF)**

PMF Maximum Water Level <sup>4</sup>: 12.76 m AHD

PMF Maximum Depth from natural ground level: 0.88 m

PMF Maximum Velocity: 1.52 m/s

### **Map E - Flood Life Hazard Category in PMF**

H5 – H1

- (1) The provided flood information does not account for any local overland flow issues nor private stormwater drainage systems.
- (2) Overland flow/mainstream water levels may vary across a sloping site, resulting in variable minimum floor/ flood planning levels across the site. The maximum Flood Planning Level may be in a different location to the maximum 1% AEP flood level.
- (3) Intensification of development in the former Pittwater LGA requires the consideration of climate change impacts which may result in higher minimum floor levels.
- (4) Vulnerable/critical developments require higher minimum floor levels using the higher of the PMF or FPL.

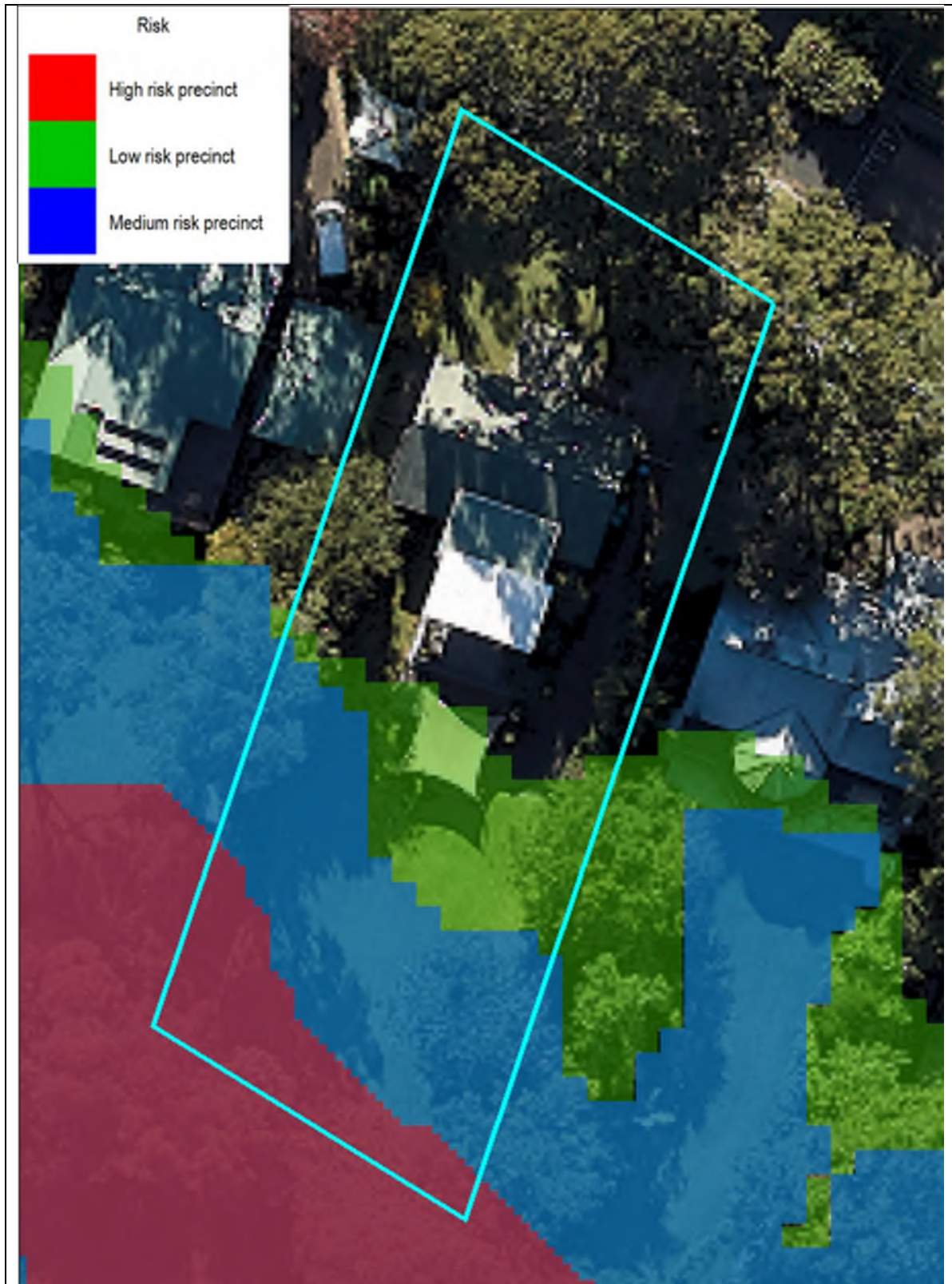


## Notes

### **General**

- All levels are based on Australian Height Datum (AHD) unless otherwise noted.
- This is currently the best available information on flooding; it may be subject to change in the future.
- Council recommends that you obtain a detailed survey of the above property and surrounds to AHD by a registered surveyor to determine any features that may influence the predicted extent or frequency of flooding. It is recommended you compare the flood level to the ground and floor levels to determine the level of risk the property may experience should flooding occur.
- Development approval is dependent on a range of issues, including compliance with all relevant provisions of Northern Beaches Council's Local Environmental Plans and Development Control Plans.
- Please note that the information contained within this letter is general advice only as a detail survey of the property as well as other information is not available. Council recommends that you engage a suitably experienced consultant to provide site specific flooding advice prior to making any decisions relating to the purchase or development of this property.
- The Flood Studies on which Council's flood information is based are available on Council's online [Flood Study Reports](#) webpage.
- If the FPL is higher than the PMF level, then the FPL should still be used as the FPL, as it includes freeboard which the PMF does not.
- If the property is affected by an Estuarine Planning Level (EPL) which is higher than the FPL, then the EPL should be used as the FPL.
- Areas affected by an EPL in the former Pittwater LGA are mapped on Council's online [Estuarine Hazard Map](#). Note that areas in the former Manly LGA affected by an EPL have been identified and will be soon added to this map.
- Council's drainage infrastructure is mapped on Council's [Stormwater Map](#). Note that locations are indicative only and may not be exactly as shown.

## MAP A: FLOOD RISK PRECINCTS



### Notes:

- **Low Flood Risk precinct** means all flood prone land not identified within the High or Medium flood risk precincts.
- **Medium Flood Risk precinct** means all flood prone land that is (a) within the 1% AEP Flood Planning Area; and (b) is not within the high flood risk precinct.
- **High Flood Risk precinct** means all flood prone land (a) within the 1% AEP Flood Planning Area; and (b) is either subject to a high hydraulic hazard, within the floodway or subject to significant evacuation difficulties (H5 or H6 Life Hazard Classification)
- The **Flood Planning Area** extent is equivalent to the Medium Flood Risk Precinct extent and includes the High Flood Risk Precinct within it. The mapped extent represents the 1% annual Exceedance Probability (AEP) flood event + freeboard.

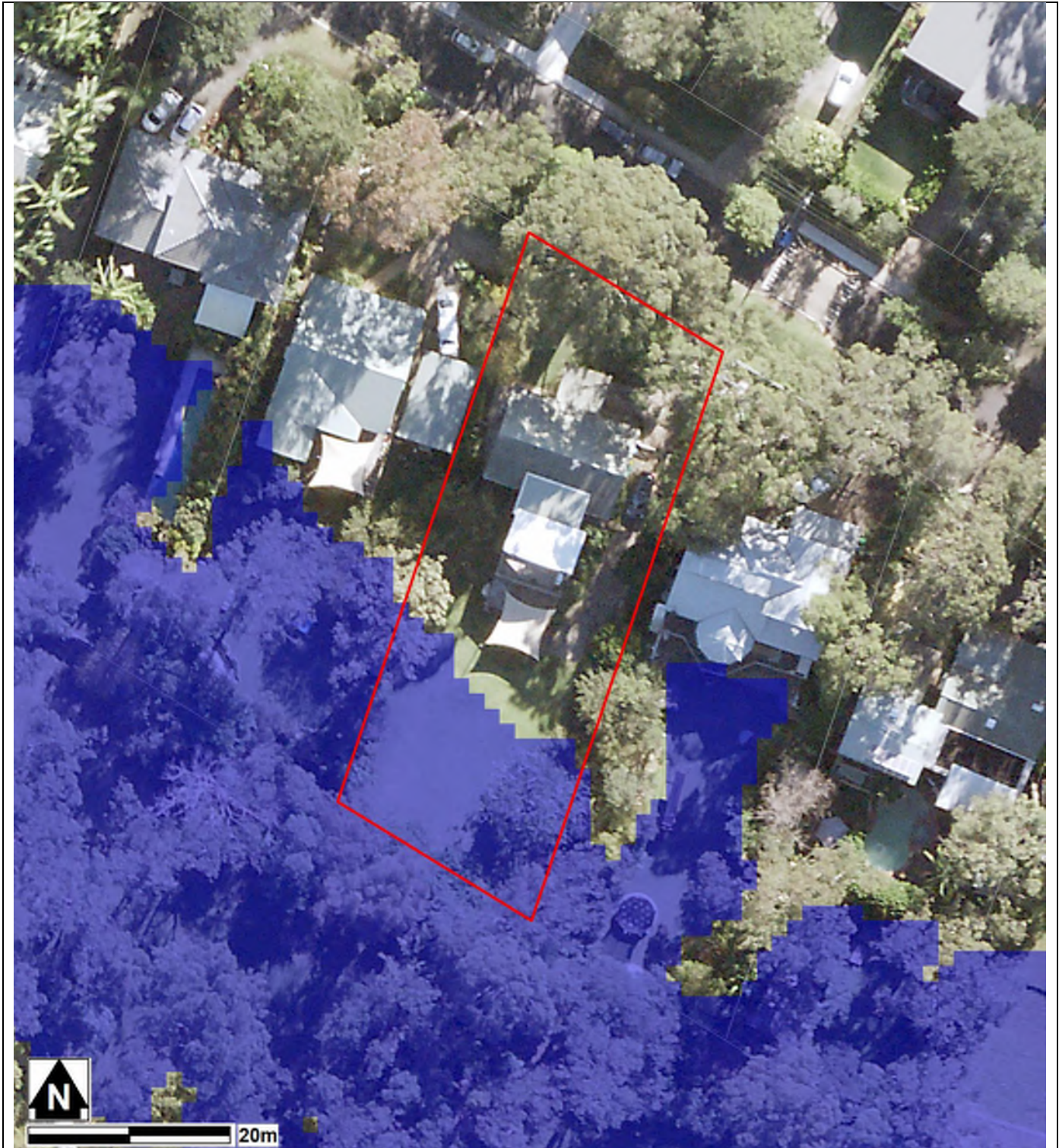
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- None of these mapped extents include climate change.



## MAP B: FLOODING - 1% AEP EXTENT

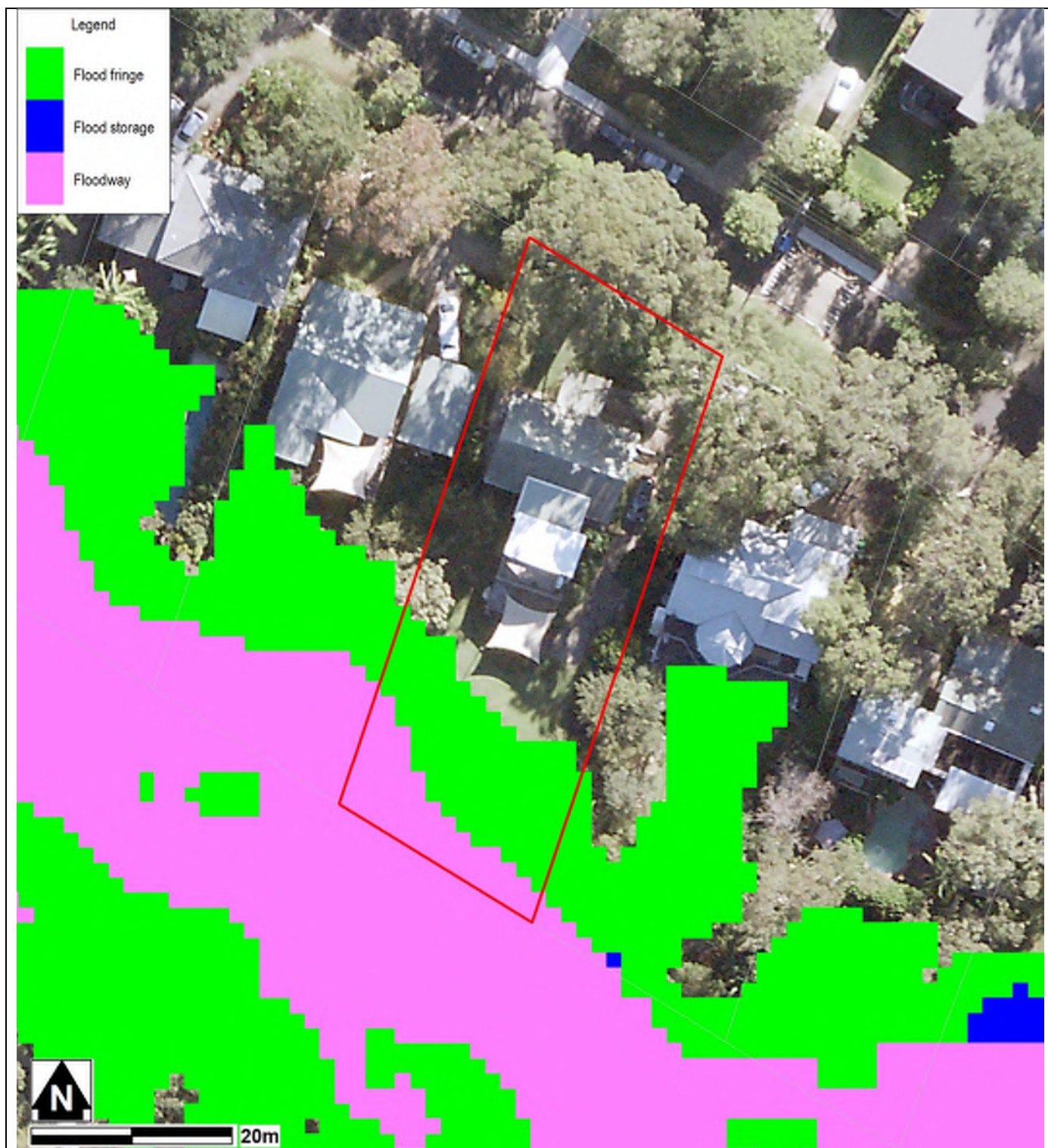


### Notes:

- Extent represents the 1% Annual Exceedance Probability (AEP) flood event.
- Flood events exceeding the 1% AEP can occur on this site.
- Extent does not include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: NearMap 2014) are indicative only.



## MAP C: 1% AEP FLOOD HYDRAULIC CATEGORY EXTENT MAP

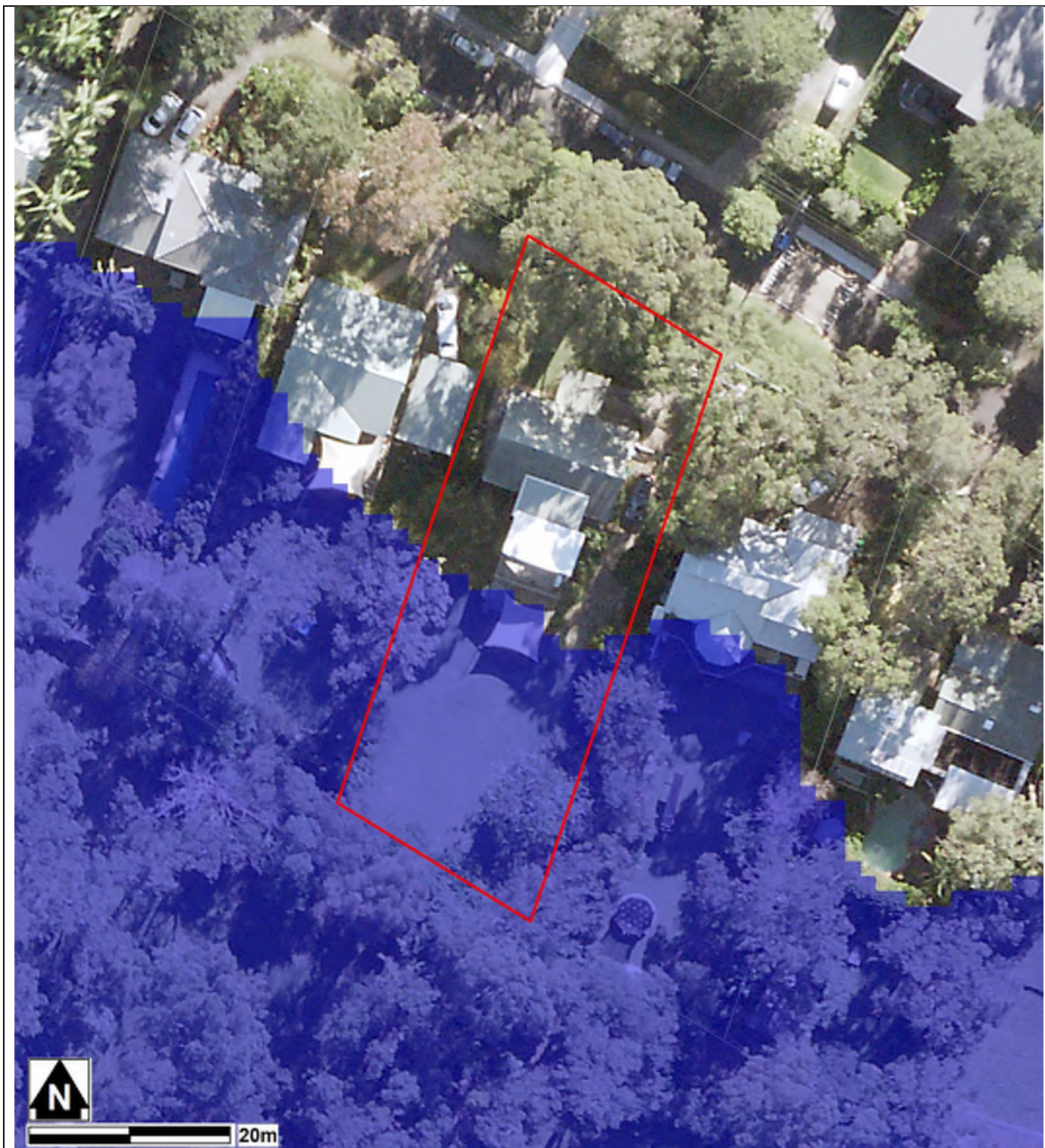


### Notes:

- Extent represents the 1% Annual Exceedance Probability (AEP) flood event.
- Extent does not include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: NearMap 2014) are indicative only.



## MAP D: PROBABLE MAXIMUM FLOOD EXTENT

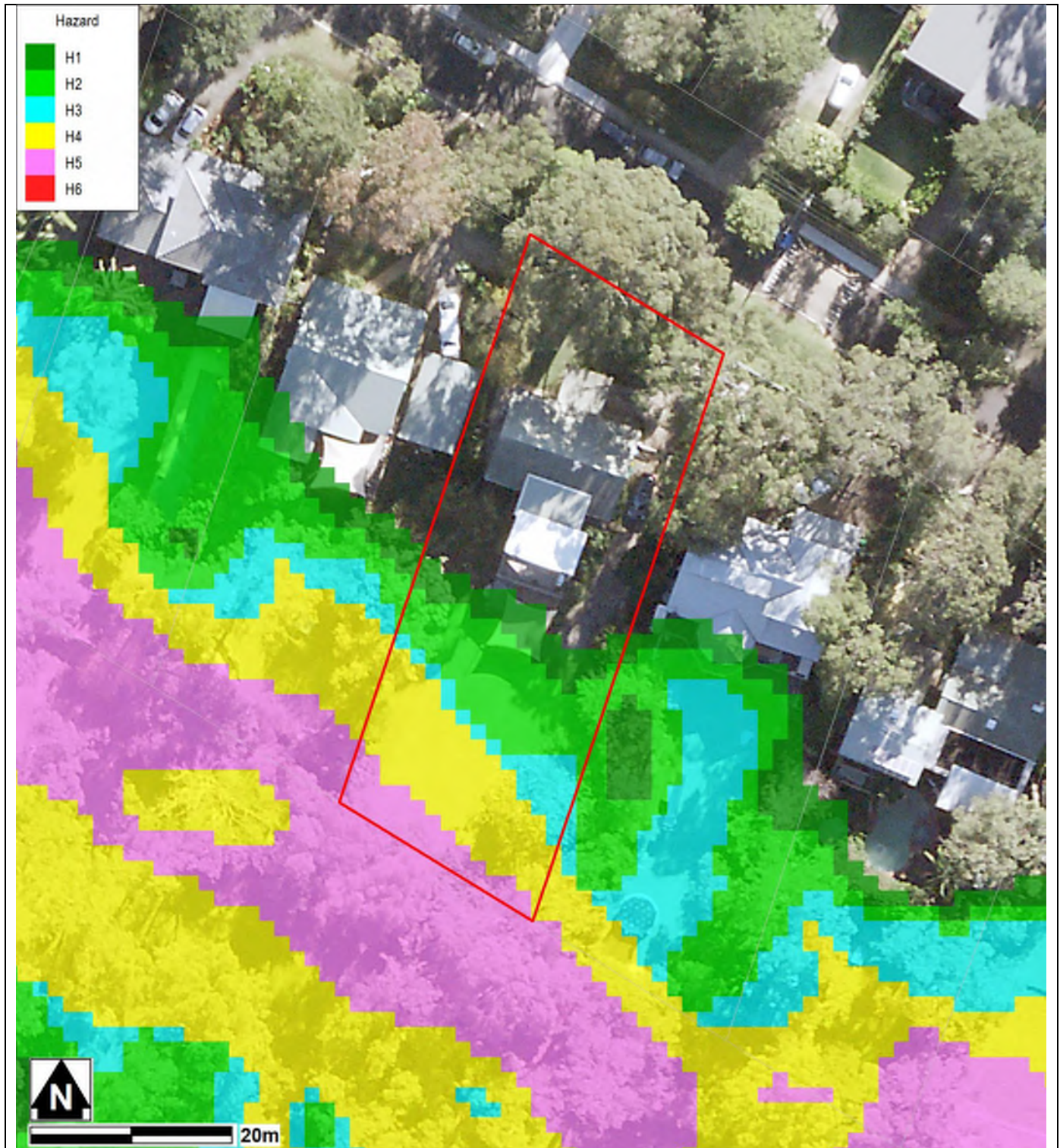


### Notes:

- Extent represents the Probable Maximum Flood (PMF) flood event.
- Extent does not include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: NearMap 2014) are indicative only.



## MAP E: FLOOD LIFE HAZARD CATEGORY IN PMF



### Notes:

- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: NearMap 2014) are indicative only.

# Preparation of a Flood Management Report

## Introduction

These guidelines are intended to provide advice to applicants on how to determine what rules apply on flood prone land, and how to prepare a Flood Management Report. The purpose of a Flood Management Report is to demonstrate how a proposed development will comply with flood related planning requirements.

## Planning Requirements for Flood Prone Land

Development must comply with the requirements for developing flood prone land set out in the relevant Local Environment Plan (LEP) and Development Control Plan (DCP). There are separate LEPs and DCPs for each of the former Local Government Areas (LGAs), although preparation of a LGA-wide LEP and DCP is currently under way.

The clauses specific to flooding in the LEPs and DCPs are as follows:

LEP Clauses	DCP Clauses
Manly LEP (2013) – 5.21 Flood Planning Manly LEP (2013) – 5.22 Special Flood Considerations	Manly DCP (2013) – 5.4.3 Flood Prone Land
Warringah LEP (2011) – 5.21 Flood Planning Warringah LEP (2011) – 5.22 Special Flood Considerations Warringah LEP (2000) – 47 Flood Affected Land *	Warringah DCP (2011) – E11 Flood Prone Land
Pittwater LEP (2014) – 5.21 Flood Planning Pittwater LEP (2014) – 5.22 Special Flood Considerations	Pittwater 21 DCP (2014) – B3.11 Flood Prone Land Pittwater 21 DCP (2014) – B3.12 Climate Change

\* The Warringah LEP (2000) is relevant only for the “deferred lands” which affects only a very small number of properties, mostly in the Oxford Falls area.

Development on flood prone land must also comply with Council's Water Management for Development Policy, and if it is in the Warriewood Release Area, with the Warriewood Valley Water Management Specification and Clause C6.1 of the Pittwater 21 DCP (2014). Guidelines for Flood Emergency Response Planning are available for addressing emergency response requirements in the DCP. These documents can be found on Council's website on the [Flooding page](#).

Note that if the property is affected by estuarine flooding or other coastal issues, these need to be addressed separately under the relevant DCP clauses.

## When is a Flood Management Report required?

A Flood Management Report must be submitted with any Development Application on flood prone land (with exceptions noted below), for Council to consider the potential flood impacts and applicable controls. For Residential or Commercial development, it is required for development on land identified within the Medium or High Flood Risk Precinct. For Vulnerable or Critical development, it is required if it is within any Flood Risk Precinct.

There are some circumstances where a formal Flood Management Report undertaken by a professional engineer may not be required. However the relevant parts of the DCP and LEP would still need to be addressed, so as to demonstrate compliance. Examples where this may apply include:

- If all proposed works are located outside the relevant Flood Risk Precinct extent
- First floor addition only, where the existing ground floor level is above the FPL



- Internal works only, where habitable floor areas below the FPL are not being increased

Note that development on flood prone land will still be assessed for compliance with the relevant DCP and LEP, and may still be subject to flood related development controls.

### What is the purpose of a Flood Management Report?

The purpose of a Flood Management Report is to demonstrate how a proposed development will comply with flood planning requirements, particularly the development controls outlined in the relevant LEP and DCP clauses. The report must detail the design, measures and controls needed to achieve compliance, following the steps outlined below.

A Flood Management Report should reflect the size, type and location of the development, proportionate to the scope of the works proposed, and considering its relationship to surrounding development. The report should also assess the flood risk to life and property.

### Preparation of a Flood Management Report

The technical requirements for a Flood Management Report include (where relevant):

1. Description of development
  - Outline of the proposed development, with plans if necessary for clarity
  - Use of the building, hours of operation, proposed traffic usage or movement
  - Type of use, eg vulnerable, critical, residential, business, industrial, subdivision, etc
2. Flood analysis
  - 1% AEP flood level
  - Flood Planning Level (FPL)
  - Probable Maximum Flood (PMF) level
  - Flood Risk Precinct, ie High, Medium or Low
  - Flood Life Hazard Category
  - Mapping of relevant extents
  - Flood characteristics for the site, eg depth, velocity, hazard and hydraulic category, and the relevance to the proposed development

If the property is affected by an Estuarine Planning Level (EPL) which is higher than the FPL, then the EPL should be used as the FPL. If the FPL is higher than the PMF level, then the FPL should still be used as the FPL, as it includes freeboard which the PMF does not.

3. Assessment of impacts
  - Summary of compliance for each category of the DCP, as per the table below.

	Compliance		
	N/A	Yes	No
A) Flood effects caused by Development			
B) Building Components & Structural Soundness			
C) Floor Levels			
D) Car parking			
E) Emergency Response			
F) Fencing			
G) Storage of Goods			

H) Pools			
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- Demonstration of how the development complies with any relevant flood planning requirements from the DCP, LEP, Water Management for Development Policy, and if it is in the Warriewood Valley Urban Land Release Area, with the Warriewood Valley Water Management Specification (2001)
- For any non-compliance, a justification for why the development should still be considered.
- Calculations of available flood storage if compensatory flood storage is proposed
- Plan of the proposed development site showing the predicted 1% AEP and PMF flood extents, as well as any high hazard or floodway affectation
- Development recommendations and construction methodologies
- Qualifications of author - Council requires that the Flood Management Report be prepared by a suitably qualified Engineer with experience in flood design / management who has, or is eligible for, membership to the Institution of Engineers Australia
- Any flood advice provided by Council
- Any other details which may be relevant

Further information and guidelines for development are available on Council's website at:

<https://www.northernbeaches.nsw.gov.au/planning-and-development/building-and-renovations/development-applications/guidelines-development-flood-prone-land>

Council's Flood Team may be contacted on 1300 434 434 or at [floodplain@northernbeaches.nsw.gov.au](mailto:floodplain@northernbeaches.nsw.gov.au) .

## APPENDIX B

### Flood Storage Calculations

**FLOOD BLOCKAGE:**  
Pool structure

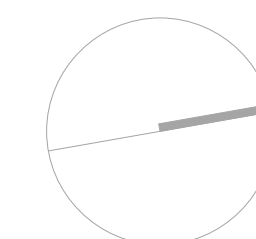
**TOTAL FLOOD STORAGE:  $-0.2\text{m}^3 + 0.2\text{m}^3 = 0\text{m}^3$**   
**THEREFORE NO NET LOSS IN FLOOD STORAGE**

NOTES

NOTE

[illegible]

DRAWING NO. DA.03 REV NO. C

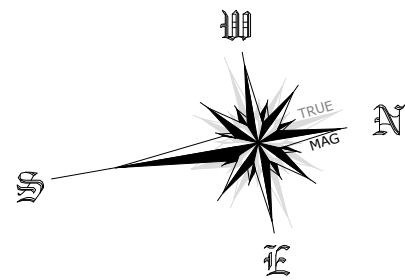


MATHIESON

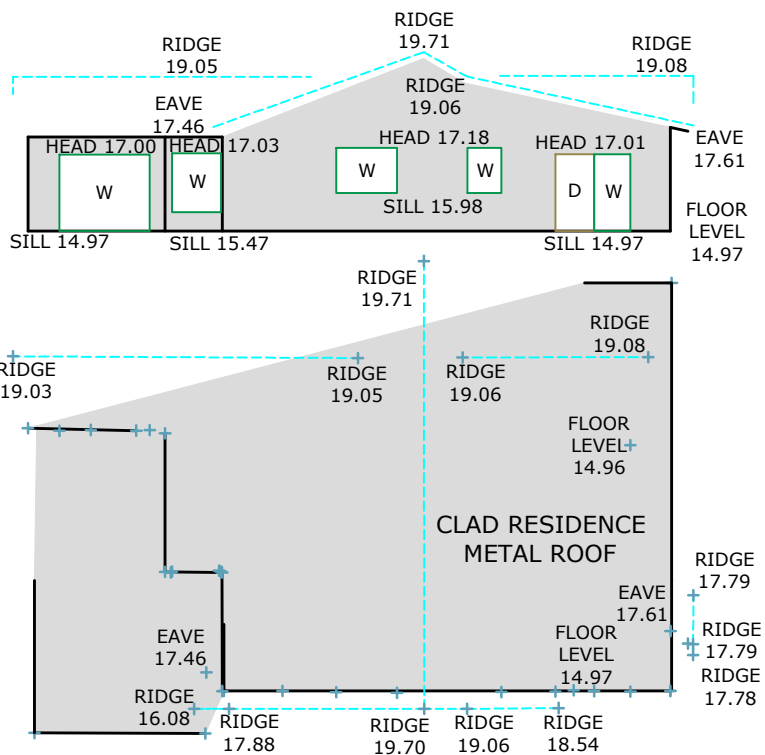
## APPENDIX C

### Proposed Development Plans & Survey



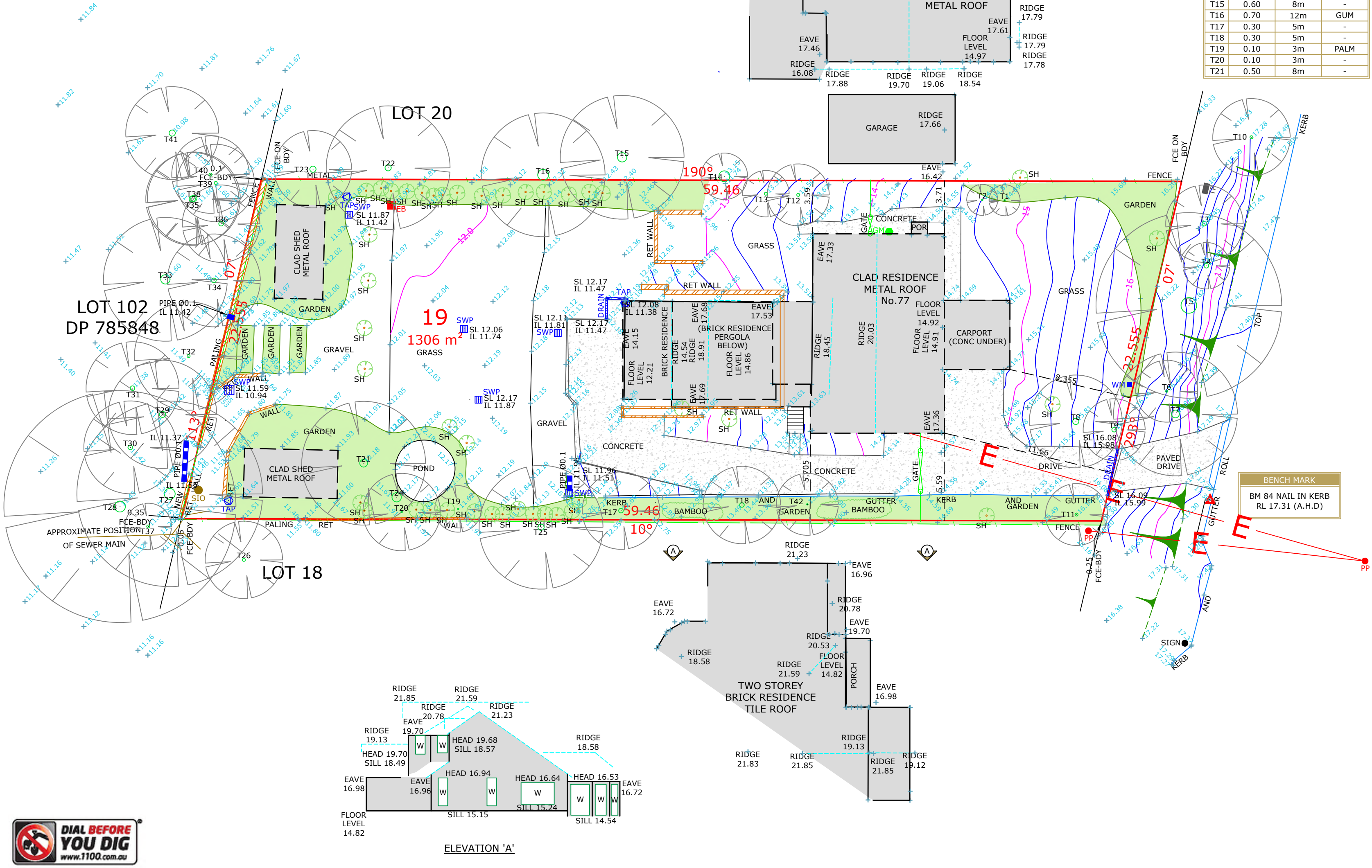
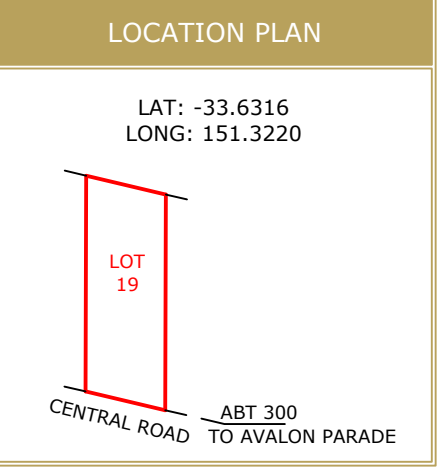


**NORTH NOTE**  
BEARINGS SHOWN HAVE BEEN DETERMINED FROM NSW LAND REGISTRY SERVICES PLANS AND ARE RELATED TO MAGNETIC NORTH. TRUE NORTH IS APPROXIMATE ONLY AND FURTHER INVESTIGATION WOULD BE REQUIRED TO DETERMINE ACCURATE TRUE NORTH.



SCHEDULE OF TREES			
	DIAMETER	HEIGHT	TYPE
T1	0.10	3m	-
T2	0.10	3m	-
T3	0.30	6m	-
T4	0.30	4m	-
T5	1.00	12m	GUM
T6	0.15	7m	GUM
T7	0.50	9m	GUM
T8	0.40	6m	-
T9	0.30	4m	-
T10	0.20	5m	-
T11	0.20	6m	PALM
T12	0.20	3m	-
T13	0.20	3m	-
T14	0.70	3m	-
T15	0.60	8m	-
T16	0.70	12m	GUM
T17	0.30	5m	-
T18	0.30	5m	-
T19	0.10	3m	PALM
T20	0.10	3m	-
T21	0.50	8m	-

SCHEDULE OF TREES			
	DIAMETER	HEIGHT	TYPE
T22	0.40	8m	-
T23	0.40	7m	-
T24	0.60	7m	STUMP
T25	0.40	8m	-
T26	0.20	5m	-
T27	0.70	12m	GUM
T28	0.70	15m	GUM
T29	0.40	7m	-
T30	0.30	10m	GUM
T31	0.30	8m	GUM
T32	0.20	7m	-
T33	0.60	12m	-
T34	0.30	6m	-
T35	0.40	10m	GUM
T36	0.30	7m	GUM
T37	0.20	7m	PALM
T38	0.40	12m	GUM
T39	0.20	8m	-
T40	0.20	8m	-
T41	0.40	8m	-
T42	0.10	5m	-



BENCH MARK  
BM 84 NAIL IN KERB  
RL 17.31 (A.H.D.)


LEGEND	
	BENCH MARK
	PHOTO POINT
	GULLY PIT
	VEHICULAR/PRAM CROSSING
	TOP OF BANK
	BOTTOM OF BANK

ABBREVIATIONS	
EB	ELECTRICAL BOX
EM	ELECTRICAL METER
GM	GAS METER
H	HYDRANT
KO	KERB OUTLET
LH	LAMP HOLE
LP	LIGHT POLE
MH	MAN HOLE
MS	MAINTENANCE SHAFT
PP	POWER POLE
R	HYDRANT RECYCLED
SH	SHRUB
SIO	SEWER INSPECTION OPENING
SMH	SEWER MAN HOLE
SR	STOP VALVE RECYCLED
SV	STOP VALVE
SVP	SEWER VENT PIPE
SWP	STORM WATER PIT
T	TREE
TP	TELECOMMUNICATIONS PIT
VER	VERANDAH
WT	WATER TAG
WM	WATER METER
WMR	WATER METER RECYCLED
WC, GC, EC, TC	SERVICE CONDUIT
W/C	WATER CLOSET

SOURCE OF LEVELS	
W/O 48073	
SYDNEY WATER	



ELEVATION 'A'

DRAWING NOTES		PLAN BY	CLIENT	REVISION	DESCRIPTION	DATE	PROJECT LOCATION	PLAN TYPE	LEVEL DATUM			
<div>1. CONTOURS SHOWN HAVE BEEN INTERPOLATED FROM SPOT LEVELS TAKEN ON-SITE AND ARE A REPRESENTATION OF THE TOPOGRAPHY ONLY. BOUNDARIES HAVE BEEN SURVEYED.</div> <div>2. SERVICES SHOWN HAVE BEEN LOCATED WHERE POSSIBLE BY FIELD SURVEY. PRIOR TO ANY SITE WORKS, THE RELEVANT AUTHORITY SHOULD BE CONTACTED TO DETERMINE EXACT POSITION OF ANY UNDERGROUND PIPES, CABLES ETC.</div> <div>3. DIMENSIONS OF ANY TREES SHOWN ON THE PLAN ARE APPROXIMATE.</div>		MATHIESON ARCHITECTS	-	BOUNDARY INFORMATION & SUBJECT EAVE AND RIDGES	26.08.2022	LOT 19 DP 8698 77 CENTRAL ROAD AVALON BEACH, NSW	CONTOUR PLAN	AUSTRALIAN HEIGHT DATUM				
			335149	UPDATE CONTOUR	20.08.2024			DRAWN	CHECKED			
								D.FISK	N.TAYLOR			
										JOB REFERENCE	SURVEY DATE	DGN/DWG No.
										0427/335149	17.08.2020	335149
											SHEET SIZE	SCALE
											A2	1:200
CLIENT REFERENCE: RM150-24												

